

The Biologist



Vol. XXV, Nos. 1 & 2

Dec., 1943

Phi Sigma

BIOLOGICAL HONOR SOCIETY

"The object of Phi Sigma is to promote interest in biological research. Although originally designated as an honorary biological research society, it should not be considered as a working guild of biologists interested in research. In effect, election to Phi Sigma should be an opportunity for better work, rather than merely election to an honorary society."

Mile Posts:

- 1915 March 17, Alpha Chapter organized, Ohio State University, Columbus.
- 1916 May, Central Governing Body organized, BIOLOGIST first issued.
- 1917 June, last War-time BIOLOGIST issued.
- 1921 February, BIOLOGIST revived.
- 1924 December, First National Meeting, Constitution revised, Washington, D.C.
- 1925 December, Second National Meeting, First Science Program, Kansas City.
- 1926 December, Third National Meeting, Second Science Program, Philadelphia.
- 1927 December, Third Science Program, Nashville.
- 1928 December, Fourth National Meeting, Coat-of-Arms adopted, Fourth Science Program, New York.
- 1930 January, Council Meeting, Ritual Revised, Norman, Okla.
December, Fifth National Meeting, Fifth Science Program, Cleveland.
- 1931 Phi Sigma Letters Registered, U. S. Patent Office.
- 1932 December, Sixth Science Program, Atlantic City.
- 1933 June, Sixth National Meeting, Seventh Science Program, Chicago.
- 1935 December, Seventh National Meeting, Eighth Science Program, St. Louis.
- 1937 December, Eighth National Meeting, Ninth Science Program, Indianapolis.
- 1939 December, Ninth National Meeting, Tenth Science Program, Silver Anniversary, Ohio State University, Columbus.
- 1942 December, Tenth National Meeting, Dallas, Texas.

Expansion:

The Constitution provides that: "An active chapter may be established in any institution of learning which requires for graduation the equivalent of four years of collegiate work, and which is equipped with facilities for research work. - - - Any petitioning group must be active for at least one year before it may be granted a charter."

THE BIOLOGIST

Vol. XXV

Denver, Colo., Dec., 1943

Nos. 1 & 2

Published by the Phi Sigma Society, an organization devoted to the promotion of interest in biological research, founded at Ohio State University, March 17, 1915. The *Biologist* is the official quarterly publication of the society, issued ordinarily in October, December, February and April, as a medium of exchange between chapters, as an interpreter of Council policies, and as a stimulus to the fellowship in science for which Phi Sigma stands.

Council

HONORARY PRESIDENT

Dr. Leon J. Cole (Zeta '25)
Professor of Genetics,
University of Wisconsin,
Madison, Wisconsin

CHANCELLOR

Dr. Paul A. Warren (Beta '20)
Botany Department,
Tufts College,
Medford, Massachusetts

VICE-CHANCELLOR

Dr. Fred A. Barkley (Omega '28)
P. O. Box 1620,
University Station,
Austin (12), Texas

SECRETARY

Dr. A. I. Ortenburger (Beta '19)
Zoology Department,
University of Oklahoma,
Norman, Oklahoma

TREASURER

Erwine Hall Stewart (Epsilon '17)
Mesa, Colorado

ACTING EDITOR

Dr. Edna Higbee
2845 Broadway Ave.,
S. Hills Sta.,
Pittsburgh, Pennsylvania

Contents

Investigations Concerning *Arenicola*
Marina and *Schizothaerus Nuttallii* 6
George Nace

An Endeavor to Invigorate The
Weeping Willow 8
Ruth Olsen

Notes on a New Species of Rodentia 10
Richard Beidleman

The Jitterbug 12
Lonnie Myers

Random Facts on Penicillin 13

Science—Practical and Impractical 14
Dr. Arthur N. Bragg

Newsletters 21

REGULAR FEATURES

Book Reviews 25

Advertising 32

Directory

OF ALL ACTIVE AND INACTIVE CHAPTERS

*The list of chapter officers for this school year will be found in the
CHAPTER NEWS section of Vol. XXV.*

ALPHA

Ohio State University, Columbus, Ohio, founded March 17, 1915, (Inactive).

BETA

University of Michigan, Ann Arbor, Michigan, founded June 3, 1916.

DELTA

University of Maine, Orono, Maine, founded January 27, 1917, (Inactive).

EPSILON

University of Denver, Denver, Colorado, founded March 5, 1917.

ZETA

University of Wisconsin, Madison, Wisconsin, founded May 30, 1917.

ETA

University of Akron, Akron, Ohio, founded April 20, 1921.

THETA

Michigan State College, East Lansing, Michigan, founded April 9, 1921, (Inactive).

IOTA

Washington University, St. Louis, Missouri, founded May 28, 1921.

KAPPA

University of Kansas, Lawrence, Kansas, founded May 31, 1921.

LAMBDA

Montana State University, Missoula, Montana, founded May 4, 1921.

MU

University of California, Berkeley, California, founded April 27, 1922.

NU

Washington and Jefferson College, Washington, Pennsylvania, founded May 11, 1922.

XI

University of Nebraska, Lincoln, Nebraska, founded May 3, 1924, (Inactive).

OMICRON

University of North Dakota, Grand Forks, North Dakota,
founded May 26, 1924, (Inactive).

PI

Emory University, Georgia, founded January 3, 1925.

RHO

University of Illinois, Urbana, Illinois, founded March 28, 1925.

SIGMA

University of Florida, Gainesville, Florida, founded December 4, 1925.

TAU

Duke University, Durham, North Carolina, founded March 4, 1926.

UPSILON

Miami University, Oxford, Ohio, founded May 7, 1926.

PHI

University of New Hampshire, Durham, New Hampshire, founded May 21, 1926.

CHI

Montana State College, Bozeman, Montana, founded February 11, 1927.

PSI

University of Washington, Seattle, Washington, founded April 7, 1928.

OMEGA

University of Oklahoma, Norman, Oklahoma, founded March 24, 1928.

ALPHA ALPHA

University of Southern California, Los Angeles, California, founded May 17, 1930.

ALPHA BETA

Mount Union College, Alliance, Ohio, founded May 17, 1928.

ALPHA GAMMA

University of South Dakota, Vermillion, South Dakota, founded May 15, 1928, (Inactive).

ALPHA DELTA

Lawrence College, Appleton, Wisconsin, founded March 7, 1929, (Inactive).

ALPHA EPSILON

University of Pittsburgh, Pittsburgh, Pennsylvania, founded March 23, 1929.

ALPHA ZETA

College of William and Mary, Williamsburg, Virginia, founded April 19, 1930, (Inactive).

ALPHA ETA

Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma,
founded March 13, 1930.

ALPHA THETA

State College of Washington, Pullman, Washington, founded May, 1930.

ALPHA IOTA

Bucknell University, Lewisburg, Pennsylvania, founded January 9, 1932.

ALPHA KAPPA

Hunter College, New York City, founded January 8, 1932.

ALPHA LAMBDA

University of Utah, Salt Lake City, Utah, founded February 13, 1932.

ALPHA MU

University and State College of Oregon, Eugene-Portland-Corvallis, Oregon,
founded November 18, 1933.

ALPHA NU

University of New Mexico, Albuquerque, New Mexico, founded April 21, 1935.

ALPHA XI

Rhode Island State College, Kingston, Rhode Island, founded May 17, 1935.

ALPHA OMICRON

Marquette University, Milwaukee, Wisconsin, founded June 18, 1938.

ALPHA PI

University of Colorado, Boulder, Colorado, founded May 24, 1941.

Investigations Concerning *Arenicola marina* and *Schizothaerus nuttallii* ¹

to be submitted to
The Federal War Man Power Commission

GEORGE NACE

The following investigation conducted in Tillamook Bay, Oregon, was brought about by the very apparent loss of valuable hours and man power during the clamming season on the Pacific coast of the Northwest. It was observed that the clam diggers lost many minutes of valuable time during low tide and a great deal of energy "digging out" the holes of *Arenicola* rather than those of *Schizothaerus*. This paper will describe the researches involved in developing a simple technique for distinguishing between the holes of these two forms.

By way of description: The *Arenicola* is a *Polychaeta* which lives in the mud flats of the Northwest coast and occupies a place in the ecology of the flats similar to that held by *Lumbricus* in the ecology of a dairy pasture. It burrows in the flats and makes holes which are about $\frac{1}{2}$ " in diameter and usually extend directly down into the flat for a distance of 10" to 18" after

which they bend and twist in every direction.

Schizothaerus nuttallii (Conr.), commonly called the "Blue Neck Clam" in Oregon and the "Washington Clam" in Washington, is a *Pelecypoda* which reaches a size of as much as 7"x4"x1.5" and is especially valuable as a chowder clam. It lives in the flats at a depth of 10" to 2' and has a "neck" of about $\frac{1}{2}$ " diameter which cannot be completely retracted. It ordinarily rests with its siphons or "neck" extended vertically to the surface of the mud, feeding by virtue of a current set up in them by their ciliated mucosa. When these *Pelecypods* are disturbed they withdraw their "necks", at the same time ejecting a stream of water which may reach 3' in height. After withdrawing their "necks" there is no way of distinguishing, on the surface, the difference between the holes of *S. nuttallii* from those of *Arenicola*.

In order to devise a simple method of distinguishing between the holes of these two invertebrates it was necessary to collect numerous specimens of each, make complete and careful dissections, and perform exhaustive studies of their habits. Studies of their habits were done in the laboratory aquar-

*The first four papers in this issue have been submitted by Alpha Pi Chapter. For the fall and spring initiation of the academic year 1942-'43 Alpha Pi Chapter required initiates to present pseudoscientific papers. Superficially each paper was to be as scientific as the author was capable of making it, but actually it was to deal with some preposterous subject. The four printed here are representative of the group.

ium but even with that handicap numerous facts were discovered. The results of the laboratory experiments will be reported at another time except to say that it was found that *Arenicola* is definitely rheotropic. That is, *Arenicola* always maintains the same orientation with respect to the prevailing current when it comes to the opening of its burrow. Also it was found that *Arenicola* comes to the opening shortly after each incoming tide has covered the flats.

No means of making the distinction required was found in the studies of their habits and anatomy so it was decided to try to modify the habits of one of the species by some simple expedient. Chemical means it seemed, after exhaustive experimentation, was the only way of modifying the habits of *Arenicola* in a way that was at all practical. *S. nuttallii* is too inactive to have its habits changed appreciably.

Numerous alkaloids and other chemicals were tried but it was found that the choice was between acetylcholine, often called the chemical transmitter of the synapse, and curare, the poison which is known for causing muscular paralysis. Curare was the choice because it produced the greatest effect with the lowest concentration.

It was found that curare in concentrations of $1/10^{10}$ would, if placed on a lateral and ventral side of the ever-sensible pharynx (the organ of locomotion in *Arenicola*), produce such paralysis that the creature no longer retained

its symmetrical balance. This lack of symmetry prevented *Arenicola* from returning down its hole and caused it to burrow in a horizontal plane about 4" below the surface.¹ 90% positive results were obtained in the laboratory.

If a small amount of curare is placed on the windward side of the opening of an *Arenicola* burrow the orientation produced by the rheotropism of the organism to the incoming tide will cause the proper surfaces to come in contact with the chemical. For commercial clam diggers who work every low tide this is quite satisfactory because after they have dug their limits of clams they only have to apply the curare to the holes in the region they plan to work on the next low tide. When they return, one "shot" with the "Clam gun", commonly called a shovel, will determine the direction of the burrow and indicate whether or not it is an *Arenicola* or a *Schizothaerus* hole.

This method has only two drawbacks: first, the toxicity of curare to humans; second, the expense of the drug. It is advised that for protection in using this technique a well constructed atomizer be used and that two sprays on the windward side of the hole just before the tide turns are sufficient. Since there are many holes it is also advised for economy that only the holes of *Arenicola* be sprayed—a simple examination near the mouth of each will show that the *Arenicola* burrow is lined with a small amount of mucus while that of *Schizothaerus* is not.

It is hoped that the results of this investigation can be used and that they are in the spirit of the efforts of the Federal War Man Power Commission to save strategic time and man power.

¹ The burrows thus produced followed the general pattern of a spiral formed by the motion of a point P determined by x and y where $x = a (\cos kt / kt \sin kt)$ and $y = a (\sin kt - kt \cos kt)$.

Where k = the constant speed of progress of *Arenicola*.

t = time.

a = a constant.

*An Endeavor to Invigorate the
Weeping Willow
or
What Happens When a Brain Cell
Begins Budding*

Expressor Ruthnia Exskonovitch Olsenowski

RUTH OLSEN

The idea of bringing happiness to the Weeping Willow came to me while I was strolling through a park one bright spring day. Upon this day everything was bursting with splendor; everything except a few poor little Weeping Willows who had actually formed a creek at their feet from lamenting. I, being of a somewhat sensitive nature, was deeply touched, and vowed to do something to lighten the burdens of these trees. Knowing that it would take some very powerful and stimulating organism or hormone to bring about this great change, I carried on several careful investigations to find such an enlightening. After meeting setbacks in trying out such things as laughing powder, vitamin N.O., and several hormones, I finally found *Bugsia muy joyosa*. To you who are unacquainted with this organism, I might mention that this is the microbe that causes the high spirits in the Laughing Hyena. Further information will be given about this minute animal later.

History

This problem, as has been revealed by deep research, seems to be original with me. No one seems to have previously undertaken such an experiment. (Praise the Lord.)

Experiments and Data

As has been mentioned, *Bugsia muy joyosa*, the Joybug, is the soundest of all sources for invigorating the Weeping Willow. Taking a brief glance at the life history of this microbe, one sees that it lives all its life in the internal organs of the Laughing Hyena. The Bugsia's actions, such as jumping up and down, and running around through the viscera of the animal, causes a tickling sensation which results in the Hyena's amusement.

My first problem then was to isolate these little fun makers. This I did by building a small pen about 1' by 2' containing miniature slides, swimming pool, merry-go-round, and various other fun devices. After placing a small Neon sign, "Fun House", over the door, and

having two trained fleas at the one door to direct the crowd, I placed my trap inside the Hyena. It was of some difficulty to force the box, which was 1' by 2', down the throat of the animal, but, after much pushing and tugging, I succeeded. The little Joybugs, upon seeing a new place for capers, needed no second invitation and rushed into the trap.

After extracting the "Fun House" from the Hyena, I placed the microbes in a culture of buttermilk, iced Postum, HCL, NaCO_3 , and a dash of paprika. An overdose of paprika, added to some cultures, caused the little Joybugs to break out in a tepid sweat and finally melt away.

After culturing for 26 days, 4 hours, 35 minutes, and 2 seconds the Bugsias were injected into the Weeping Willow. A common medical hypodermic syringe with a wood borer point was used as an injector. The injection was given to either young shoots or young branches and was made directly into the fibro-vascular bundles.

Results

Reactions were received almost immediately. *Bugsia muy joyosa* seemed to take to the new environment with ease—climbing up the tracheids and sliding down the sieve tubes, and even climbing out on the leaves to dangle. The effect on the tree was unbelievable; the plant lifted its limbs straight up in Poplar fashion and literally

shook them in ecstasy. Two trees showed very slow reactions, so I decided to investigate. To my amazement I discovered that the Joybugs were lazy. It seems that they had been obtained from a hyena of the deep south—namely, from Georgia's House for Homeless Hyenas.

Very serious reactions resulting in actual hysteria were brought about by overdoses of serum. The trees literally shook themselves to pieces. All these reactions lasted only as long as the Bugsias kept their enthusiasm. Because of the long distances to be covered inside the trees, the Joybugs would become tired and new injections would have to be made. Because of the vigorous reactions to the treatment, only young trees were injected.

However, this method brought about disagreement between the active youngsters and their more sedate parents. Because of this disagreement I was petitioned by frustated parents, who believed their family life was being destroyed, to cease my activities.

Summary

From this review of my work it can be seen that Weeping Willow can be pepped up by injections of those beaming, effervescing Joybugs, *Bugsia muy joyosa*. However, before further work can be done, an extensive adult education program showing the papa and mamma willows that family life will not be destroyed if the young willows are happy will have to be sponsored.

Notes on a New Species of Rodentia

RICHARD BEIDLEMAN

Many years ago, while on a fishing trip through the high Rockies near majestic Mt. Audubon, I quite accidentally came upon a mammal of extraordinary means, which, through the intervening years, has come to be an object of extreme investigation and curiosity throughout the entire West. In 1888, when I first returned from the alpine wilderness with stories of this amazing creature, I was laughed out of scientific meetings and classrooms. But as scientist after scientist bumped into this bizarre animal, preening his beard on the rocky slopes of sun-kissed Mt. Audubon, each has come to me with apologies on his lips and a wild gleam in his eye.

Being the co-discoverer of this six-legged animal, I took upon myself the job of naming it, calling it, quaintly enough, *Puffilopus sextipodia Puckerstoppli*, or more commonly the six-pedeled puffil. I took the liberty to name it after J. Dementia Puckerstopple of Swammerdam University, Boston—for it was Puckerstopple who first glimpsed this little blue-eyed animal, peeping his quivering nose from a crevice in the mountainous substratum. And it was with Puckerstopple that I closely examined this strange beast and classified it for all time.

The six-pedeled puffil is a small animal, closely related to the cony of the high alpine regions. Its weazened body is covered with thick purple fur, which should readily distinguish this tiny rodent from anything else on six legs you ever saw. Its ears are vestigial, being carried in a brood pouch beneath the lower mandible. I doubt very greatly, though, whether the loss

of its ears has in any way endangered this animal's battle with its environment, because in all my years of tramping through the high mountains, I have never found my own ears useful for anything but being frozen off by biting alpine winds. And perhaps, indeed, this little animal's ears were frozen off at a tender age, and his mother didn't take him to a doctor right away. Who knows?

Of no scientific importance, but of extreme aid in distinguishing this fiendish rodent in the field is its possession of not four but six legs. I repeat, six legs, all attached ventrally to the purple-furred body. There are two pairs of legs attached in the usual places—you know, two at the front and two behind, like man only different. Then as an added attraction, this gold-toothed puffil has, projecting from the last segment of its cephalothorax, a pair of highly modified, thirty-three jointed appendages, which, at rest, are retracted into the visceral cavity. I have every reason to believe that these strange legs, if we might call them that, are used by the puffil to scratch his stomach after eating a full meal of caddis-fly cases and "wheaties".

Many were the hours that Puckerstopple and I lay cramped in our sleeping bags on the rock-strewn slopes of venerable Mt. Audubon, watching the six-pedeled puffil lie contentedly on his purple-furred back against a clump of alpine forget-me-nots, his last pair of legs leisurely crossed one over the other; his first pair of legs busily occupied, holding in one grubby paw a handful of gritty caddis-fly larvae cases and in the other a sixteen ounce econ-

omy size box of "wheaties"; and his auxiliary second pair of legs vigorously scratching the sparsely purple-haired tubby tummy, distended with goodies of the wilderness. After such a meal, the diminutive little puffil would yawn, do fifteen or twenty push-ups, depending on the weather, and crawl into his crevice in the substratum.

One beautiful July day, with a driving snow storm making field work almost impossible, Puckerstopple suggested that we invade this rodent's home in the hopes of ferreting out some further insight into the character of this rare mammal. Fortifying ourselves with a bar of Baker's chocolate, a box of raisins, and five hundred gallons of New England rum, we broke our way through the snow drifts flanking majestic Mt. Audubon, and after considerable confusion when we accidentally fell off a sheer precipice hidden beneath the snow, we came to the home of the puffil.

No welcome mat woven from Tiny *Lewisia* leaves greeted our weary eyes, but we barged in anyway—and found, as we suspected, the six-pedeled puffil deep beneath the ground on a cozy bed of alpine forget-me-nots. As we approached him, he looked up and nodded sleepily at us between scratchings and enormous bites of cream-of-wheat—for, as we could plainly see, this was too cold a day to eat "wheaties".

Our afternoon with this strangest of all purple-furred mammals was one of the most enjoyable afternoons I have ever spent—except perhaps for that one

spent with Hedy Lamaar in Pasadena watching the Rose Parade three years ago—but that was before the war! Our new-found friend, the puffil, was a gracious host; and when he heard that we were zoologists, he kindly condescended to show us his family scrapbook and explained to us the what and why of his peculiarities. I took copious notes on everything this blue-eyed rodent said, while Puckerstopple drew habitat sketches of the interior of the puffil's home on the bottom of his snowshoes.

Puckerstopple seemed to be quite taken with the gold-toothed rodent; and when he discovered that this shy puffil had a museum of over 500,000 different caddis-fly larvae cases, collected from all over the world and classified according to edible qualities, it was all I could do to drag my good scientific friend with me, as we crept out of the puffil's rock-bound home into the fresh, snow-filled ozone of eventide and turned to the direction of our camp, some four miles down the snowy flanks of awe-inspiring Mt. Audubon.

Fifty-five years have passed since J. Dementia Puckerstopple and I first cast eyes on this strangest of strange mammals, the only species of its kind seen and described in the annals of American—nay, even international science. And I can see him yet, a demur, wistful-faced rodent with baby-blue eyes and a protruding gold tooth, lying there in front of his burrow beneath the alpine sky, scratching his rotund tummy and gazing up at the billowing thunderclouds overhead.

The Jitterbug

LONNY MYERS

Taxonomists continue to disagree on the correct classification of the jitterbug, but recent investigations have supported the increasingly accepted theory that this weird creature belongs to the species *Bugus wiggliensus*. The body is elongate, bilaterally symmetrical, with great variety in hair and eye color as well as general circumference and length. The female may often be recognized by a flexible carapace which ends abruptly at a point distinctly anterior to the Patella. The male is enclosed in a biramous carapace frequently supported by brightly colored and (in pre-war days) elastic suspensory ligaments. The habitat of the jitterbug varies from the smoke-filled, blatant, crowded fascimile of a room to one which is thick with smoke, blaringly blatant, and sufficiently crowded to scare any sardines.

A discussion of its internal organs is impossible because of the lack of

available technique in making such a study. The difficulty arises from the relentless and rapid oscillations of his entire anatomy. In fact, the appendages have never been counted because of this uncanny expression of perpetual motion (a challenge to any truly ambitious biologist). Attempts have been made to observe *Bugus wiggliensus* when forced into an inactive state, but always in vain. As soon as life floats his bouncing body, the jitterbug immediately assumes characteristics phenomenally like *Homo sapiens*, though while alive there is absolutely no trace of similarity. He is distinctly allied to his fellow Hemiptera through his invariably nocturnal appearance which is so typical of *Cimex lectularis*, or the bedbug. The evolution of the jitterbug is another disputable question. I belong to the school which believes, regardless of other factors, that the Mexican jumping bean plays an important role in its ancestry.



Random Facts on Penicillin

During World War I medical men were pleased to find nature helping to cleanse the wounds of soldiers having to remain on the battle fields for hours or even days. This discovery brought about the "trade" of growing maggots to be placed in wounds containing dead flesh, pus, etc. The maggots ate all the "bad" material and only stopped when the wound had been thoroughly cleansed and good healthy flesh and blood were encountered. Hundreds of soldiers lives were saved.

Today, thanks to the chance discovery of Dr. Alexander Fleming, professor of Bacteriology at the University of London and resident pathologist at St. Mary's Hospital, London, nature has produced a still greater weapon against the diseases which are attacking service men and civilians. Penicillin has an even greater bacterial potency than the sulfonamides. Penicillin is obtained as a product of the metabolism of bacteria and molds. It is non toxic to animals. In studying the mold Dr. Fleming thought it was a strain of *Penicillium rubrum*. This was later corrected by Thom, who identified the organism as a strain closely related to *Penicillium notatum* Westling.

In manufacturing Penicillin great care must be taken because the growth of the mold can be influenced by a large number of factors which in turn alters the potency of the material. Care must be taken in selecting the strain to be grown. The pH must be watched because a dropping of the pH causes the formation of Penicillin B and other products. The liquid medium in which penicillin is grown must be assayed frequently so that the largest harvest can be made. When finally obtained the product is a crystallized salt, either sodium or calcium.

One company has announced that by

advanced methods their company can produce Penicillin in $2\frac{1}{2}$ to 3 days without using cumbersome equipment.

The Board of Trustees of the University of Illinois has announced the acceptance of a grant of \$25,000.00 a year for three years made by the Upjohn Company, to be devoted to the academic study of the structural composition and possible synthesis of Penicillin.

The doctors at the Mayo Clinic have found that the administration of calcium salt of penicillin by the continuous intravenous drip method can be used without untoward reactions. The largest dose given was 44,000 Oxford units.

Dr. Albert L. Elder, head chemical advisor of the WPB, has been made coordinator of the Penicillin program.

The Heyden Chemical Company is to build a plant at Princeton, New Jersey which will have a rated capacity of 5,000,000,000 units of penicillin a week.

Dr. George Robinson and Dr. James E. Wallace of Allegheny Hospital, Pittsburgh have developed a crude method of treating with penicillin. They saturate gauze with a solution of yeast, sugar, starch and glycerin to provide food for the penicillin producing mold. The gauze is then sterilized and inoculated with mold and used as a dressing for infected wounds. The mold apparently grows and produces enough crude penicillin on the dressing to overcome the infection in certain cases.

Dr. Henry Welch, chief of the micro-analytical division of the Food and Drug Administration is preparing a description of the methods used in assaying penicillin. Five different tests are used in assaying. These are sterility, moisture content, potency, presence of pyrogens, and toxicity.

Science—Practical and Impractical

DR. ARTHUR N. BRAGG

During my student days I was once approached by a middle-aged New England carpenter who had just learned that I was a graduate student of zoology. Our conversation went somewhat as follows:

"Mr. Bragg," said the carpenter, "Just what is this zoo-ology that you are learning at the university?"

"Zoology", I replied, "is the study of animal life in all of its phases. It attempts to discover what it is that we call life as exemplified by animals; how this is manifested in various ways; and, through this, what kinds of animals occur on this earth and how each lives."

"But", said the carpenter, still very much puzzled, "What good is it; I mean, how can we use it? How does it affect us?"

Whereupon I explained as best I could that through the application of facts learned about animals we could save our crops from destruction and prolong human lives

"Oh, I see", said the carpenter, "When you graduate you will earn your living killing potato-bugs, worms, germs, and such things."

"No", I replied, "I shall leave these practical considerations to others more interested in them. What I expect to do is to teach the subject of zoology to students in some college or university and to spend what time I can spare from my teaching duties in the further study of animals in the hope that I may

add some small part to the world's store of knowledge. In other words, I shall teach and do research."

"I thought you said that you were learning how to kill bugs and germs. I guess I don't understand yet", said the carpenter.

"I'll know *how*, all right", I replied. "But it happens that I, personally, am not particularly interested in the practical application of zoological knowledge to human problems, although there are many others who are".

"Oh, now I see", said the carpenter. "You go to the university to learn about animals. Then you teach it to young men and they will pass it on to others. It's of no real use except that it will give you an easy living. Smart boy! It will be a lot easier life than sawing boards and pounding nails like I have done for thirty years while I tried to raise a family."

This incident illustrates two important facts. On the one hand, here was a man who, in his fifty-odd years of life, had gained no understanding of what science means, what scientists are trying to do, or what good purposes such endeavors may serve. Furthermore, he was not unintelligent, merely uninformed; and he was actively curious about these matters or he would not have approached me in the first place. On the other hand, here was a young man who understood clearly what the carpenter wished to know, who aspired to teach these very things

to generation after generation of university students, but who became practically inarticulate when confronted with the honest and simple questions of the carpenter. Less than a year later this young man actually did enter university teaching.

During the years since this incident occurred, it has become increasingly evident to me that there are many others, like the carpenter, who have failed to understand what science is and what the scientist is trying to do; and many of these are intelligent and otherwise well-informed people. The word *science* has come to mean almost all things to all people; perhaps, partially at least, through the inability or unwillingness of individual scientists to explain to the public exactly what science is and to justify their own pursuits. This has been done beautifully for the scientists by Dr. A. J. Carlson of the University of Chicago; but I have seldom found it so much as attempted for the general non-scientific public.

Let us illustrate some of the confusions in the use of the word *science*. In the *Atlantic Monthly* for June, 1941, Anne Morrow Lindbergh, speaking of the recent waves of social and political unrest in the world, remarks, "The causes, it seems to me, go back to actions of our own in the last century, to the impact of science on the delicately balanced life of man." What Mrs. Lindbergh actually means is the impact of technology on the delicately balanced life of man; for, as will appear later, science impinges directly upon nothing but ignorance.

Some years ago, a leading churchman of England proposed a moratorium on science in an attempt to ward off the catastrophe of war which he foresaw. He thought that scientific progress should cease in order to allow social integration to become effected.

Scientific knowledge had so far outstripped social understanding that this was the only way that he could see to avoid a cataclysm. Subsequent events throughout the world have abundantly proved the keenness of his insight, but was he not also confusing science and technology? Whether or not this is so, it is not science which is at fault, but the non-ethical applications of scientific knowledge. Science seeks only to know the truths of nature: and many of us cannot see how knowledge of truth of any kind can harm anybody. It is manifestly unfair to charge to science the inability of people to use truth for intelligent social progress.

Everywhere I turn I find science confused with technology, not only in the popular advertisements which are designed to catch the gullible but also in articles and addresses presented to the more thoughtful members of society. "Science says" has become a popular catchword; and whenever the average individual hears the word scientist his first thought usually is of a physician, inventor, engineer, or public health official. The worst of it is that much of this confusion, all too common in normal times, is fast becoming accentuated by the importance of technology in the war and in the war effort in America at the present time.

But the word science has been used in quite other senses. Also in the *Atlantic Monthly* for June, 1941, President Emeritus Lowell of Harvard University speaks of "linguistic science" as opposed to the study of the thoughts of the ancient writers as expressed through the medium of their respective classical tongues. It is obvious from the context that Dr. Lowell here uses the term *science* for the mechanics of language—of grammar and syntax, its architecture, if one may so speak. This use of the word *science* to apply to the mere mechanism or framework through

the medium of which some more intangible entity emerges is quite common, especially among men of letters. Such people are using the term in its old and more literal sense, that is, as classified, technical knowledge, regardless of its content. It is not usually so employed among scientists.

Yet, even scientists themselves are not always clear or consistent in the use of this basic word. Mathematics is considered a science in practically every university in the world and there are many mathematicians on the membership rolls of Sigma Xi, the national society for the promotion of scientific research. Yet, Professor C. V. Newsum, a mathematician at the University of New Mexico, addressing the Southwestern Division of the American Association for the Advancement of Science, implied by his title, *Mathematics and the Sciences*, that his subject was something else than science. It was abundantly evident from his text that Professor Newsum had a true conception of the nature and meaning of science; but he failed to make it clear, to me at least, what mathematics is if not science.

Many difficulties arise from these diversified and sometimes loose uses of the word *science* and it is no mere quibble to point them out. In the first place, the use of words is a tricky business. It is not what one calls things that is important, but what one means. Names are like handles—handles with which to manipulate ideas. It makes little difference which handle one chooses in any given situation except that each must be certain that his handle is the same as that of another with whom he attempts a discourse. Expressed differently, it makes no difference whether the new baby is named Henry or John, but confusion is certain to result if some know him as Henry,

others as John, and still others as James or something else.

If we are to determine with any degree of exactness the meaning and significance of science, particularly as a scientist views it, we must first find a definition of the word *science* which is acceptable to a scientist. I shall attempt this by first showing what science is not. Then, after clearing away the debris, I shall formulate a definition which I believe to contain the essence of what a scientist means by the word.

As is commonly known, the word *science* is derived from the Latin *scire*, to know. Hence, most formal definitions start basically with some modified conception of the word *knowledge*. "Knowledge", "integrated knowledge", and "an integrated knowledge of nature" are some of the shorter definitions which I have seen. Webster's International Dictionary gives several definitions, which, paraphrased slightly for brevity, may be expressed as knowledge of principles on facts: specifically, "accumulated knowledge which has been systematized and formulated with reference to the discovery of general truths or the operations of general laws, especially such knowledge when it relates to the physical world". The Oxford, Standard, and Century Dictionaries agree substantially with the International. Let us now examine these definitions for their adequacy from the viewpoint of a scientist.

If science is knowledge, then knowledge of anything and everything must be a part of science. Even if *we* modify this to *integrated knowledge*, a house maid, a farmer, or an industrial laborer, in so far as each understands the basic principles of his trade or calling, is a scientist—and so was the carpenter of my student days. Probably no one would think of such people as scientists nor of their trades as repre-

senting science, yet the definition implied by so doing is not very far from that implied by Dr. Lowell's "linguistic science". The plain fact is that *science* has come to mean much more than integrated knowledge—more, and at the same time, less; for an integrated knowledge of language, of art, or of literature, however profound or however valuable any one of these may be, it is not science.

Many scientists would say that the word *science* should apply only to the study of or the knowledge of natural phenomena; but here, again, we meet with the difficulty of words. What are natural phenomena? Is it not as *natural* for human beings to speak and to have normal social intercourse as to eat or to produce? If so, would not the study of language (and its offshoot, literature) and the study of social forms (etiquette) be as much science as a consideration of the physiology of digestion or of reproduction? Here, indeed, is the basic difficulty in the whole matter. If we apply the word *natural* in its broadest sense, then everything in the universe is natural and everything we know or can know is a part of science. This is equally true of many words with broad and narrow meanings. For example, biology is often defined as the science of life. Since everything which pertains to life may logically be considered a part of this subject, this must be true of all factors in the environment of all organisms. But the environment includes changes in the weather, which, in turn, depends upon ocean currents, the sunspot cycle, the tilt of the earth toward the sun, and a host of other interrelated natural phenomenon. If we follow this to its logical conclusion we will find that biology, as the science of life, includes within its scope all that we know or can know. In similar manner, chemistry is the science of matter. If

we take this in its broadest interpretation, we are forced to the conclusion that chemistry, not biology, embraces all knowledge. So also with physics or astronomy. The difficulty is that our definitions are too broad.

What, then, is science? As we have seen, it is not merely knowledge, nor even integrated knowledge; although it is obviously based to some extent upon these. It is not the ability to build bridges, rid swamps of mosquitoes, or prevent diseases in man or his domestic animals; although, again, men having these abilities may be scientists. Although technical proficiency is prerequisite to all successful scientific endeavor, the knowledge of techniques is not science; nor, necessarily, scientific. Science is at once a method, a point of view, and an ideal.

As a method, science uses the data of sense preception, directly or indirectly; holding constant all factors except the one being tested, it tries the same thing over and over until the facts are clear (the experimental method); or, it observes more or less at random thousands of times until all essential factors in a given situation are understood in relation to all other factors. Following the gathering of these data, the facts are correlated by inductive reasoning while every effort is made to limit or exclude subjective thinking which might influence the result. These correlations result in theories. The theories are then subjected to the same process; discarded, modified, combined, or improved and refined, until some generalization to which no exception can be found emerges. This generalization, a scientific law, is then considered a segment of truth upon which it is safe to base reasoning and correlations of further data while in search for other laws. It is especially to be noted that scientists do not formulate theories and then try to prove

them—instead, whenever they do formulate theories, they test them to see whether or not they are true. There is a world of difference between these two methods!

As a point of view, science is skeptical. It accepts only that which has been tested many times by many people. It does not appeal to authority when in search for truth. Many times have I told my students, "If the book disagrees with the animal, believe the animal; books or their authors may be mistaken; nature never is!"

As an ideal, science may be best expressed, perhaps, in terms of what a scientist should be. The first prerequisite of a scientist is absolute honesty in intellectual matters; the second, an insatiable desire to know the truth and a compelling urge to seek it regardless of all consequences to self, family, pet ideas, or considerations of financial gain; the third, intellectual proficiency sufficient to see through shams, half-truths, bigotry, and self-centered or anthropomorphic distortions of the truth perpetrated upon an unsuspecting world for purposes of self-aggrandizement or financial profit, either nationalistic or personal; the fourth, a critical, yet kindly, attitude toward all works of others and of himself in whatever field of endeavor, based upon the ability to find errors either of fact or of reasoning, ruthlessly to search them out and expose them, to the end that truth alone shall, at last prevail; and, fifth, a humble attitude which recognizes his own human weaknesses and not merely tolerates criticism but actively seeks critical appraisal of his work, again solely in the interests of truth. Without all of these characteristics in some degree, no one has a right to be called a scientist. Nobody ever attains these ideals completely but all who have any right whatever to be considered scientists must be conscious

of them and seek to attain them by every possible means. "The truth, the whole truth, and nothing but the truth" is sought in scientific laboratories with far greater diligence than in courts of law.

Since these ideals are characteristic, not only of science but of all scholarship, we are prepared at last to give an adequate definition of science. Scholarship is to me *The Search for Truth. Science is scholarship applied to nature.*

III.

But the carpenter asked, "What good is science? How does it affect human life?" Is it, after all, only a striving after unattainable ideals all of which have been preached, written about, dephrased, and (much more rarely) exemplified since they were formulated in a mountainside in Palestine nearly nineteen and a half centuries ago?

Till recently, these were difficult questions to answer and many scientists, even as I in the conversation with the carpenter, have been led into error in attempting an answer. Usually, when a scientist is confronted with the blunt question of a practical-minded man, "But what *good* does it do"? he falls back upon "the wealth of gadgetry" which has followed in the wake of scientific progress. Spectacular feats of engineering like the construction of Boulder Dam or the building of the Golden Gate Bridge are put forth as examples of scientific progress: or other technological achievements are extolled such as the conquest and control of malaria, yellow fever, or plague; the conservation of natural resources such as that attempted with considerable success by the United States Fish and Wild Life Service, the Forest Service, and the Soil Conservation Service; the improvement of farm animals and crop plants through the application of the known facts of genetics or by the use

of the newly found plant hormones, or drugs such as colchicine. Sometimes, however, a different approach is used. It may be carefully pointed out, for example, that radio, with all that it has meant and can mean in the enlightenment and entertainment of people, was made possible as a direct result of the discovery of the Hertzian waves by a European scientist who took no thought of practical applications when he made his studies.

Both approaches rest upon the basic assumption that the final goal of science is the practical application of natural knowledge—and in this both are dead wrong! This is the goal of technology, not of science. Any scientist who states or implies that this is ultimate justification of science only adds to the confusion in the public mind and tends to defeat his own end in his search for truth.

Science differs from technology mainly in point of view. Science attempts only to learn the truths of nature; technology, to apply these truths to human welfare (or human destruction, as in case of war). Nothing is scientific which does not seek truth; nothing technological which does not seek application of natural knowledge to human needs or wants. Both are of the utmost importance—but they are not the same thing.

Now, does this imply that a physician, engineer, or inventor cannot be a scientist? It implies no such thing; for, whenever a technologist searches for natural truths, even to serve practical ends, he is as much a scientist as anyone provided he uses the scientific method and, for the time being, puts truth before practicality. In a similar manner, a scientist may turn technologist temporarily by the simple expedient of a change in his point of view. In fact, experimental scientists often do just this in designing technical

equipment not otherwise available to their needs.

It used to be fashionable in scientific circles to scorn practicality—to insist that science was somehow on some higher, untouchable plane—and to look upon any one who applied scientific knowledge to human welfare as a sort of necessary nuisance. In those times to ask a scientist what practical value his studies might bring was taken almost as an insult. Fortunately, this attitude is passing, although some of it still lingers in some places. It is, essentially, a defense reaction on the part of the scientists against the misunderstandings of the public as to meaning and significance of science. As such, it is a very human and understandable reaction. But it is not a part of the scientific attitude and, therefore, must be weeded out and utterly condemned. Incidentally, it is no accident that the decline of this attitude among scientists was coincident with the development of the great laboratories of industrial and medical research.

But science has another characteristic which some of its exponents believe to be of even greater importance to human existence than its obvious function as a cornucopia for technology. Before the outbreak of the present hostilities in Europe, even before the now wholly discredited era of appeasement in Great Britain and France, American scientists went on record in a signed statement which was widely circulated, declaring stoutly that there could never be any such thing as a nationalistic science. It is contrary to the very essence of science to speak of an Aryan physics, a communistic genetics, or an American sociology. A scientist, to work at all, must be free—free to speak his convictions in his own field without fear or favor; free to teach his subject as it seems to him best; and free to evaluate openly and with-

out political or other bias or fear the ideas and writings of his co-workers, even though they be those of his administrative superiors. It should not be necessary to point out that in exercising these freedoms, a scientist should not forget his responsibilities nor his humility—but any man who because he is afraid does not speak the truth as he sees it and insist upon his right to do so thereby forfeits all right to be considered a scientist, no matter how much he may know. This may seem a harsh doctrine but it is a fundamental one, not only for science alone but for all scholarship.

IV.

My train of thought in writing all of this has been that a general confusion exists as to the meaning, function and significance of science, either as a subject or as a cultural force, and that the greatest amount of this is due to the failure to distinguish between technology and science. The present is not an

“age of science”, as is often stated; rather, it is an age of technology. It is not even desirable that there should be an age of science; instead, what the world needs is an age of scholarship, of which science is only a part, albeit, an important one.

Science is neither some mystical god whose aim is better and more comfortable human living, through the development of better toothpastes, cigarettes, and motor cars, as most popular advertising portrays it; nor is it a monster bent on devouring man through his inability to use the forces unleashed by it for his own better good. Science is only one of a half dozen or so forces which shape cultural trends. It has not yet “come into its own”. It will do this, not when it dominates the world as some might think, but when it is able to take its proper place as a generally recognized cultural force in the balance among technology and literature, art, history, religion and other forms of scholarship.



Chapter News Letters

Beta

—University of Michigan

The University did not open until the first of November. An open meeting was held November 10th. Professor R. C. Hussey of the Geology Department discussed "The Dinosaur Parade".

HARRIET SMITH,
Secretary

Eta

—University of Akron

On December 17, 1942 Eta chapter pledged Lewis Helfrich and initiated Bartholomew Clemente, William Davis, Evelyn Mayers and Evelyn Thigpen at an evening dinner meeting. Later on February 25th, Mrs. Gladys Robinson was initiated and the following group was pledged: Stella Alogdelis, Mary Louise Ahern, Helen Baird, Thelma Crawford, Martha Klein, Robert Smith, Theodore Suie and Jean Swartz. Eta chapter had three groups of officers last year due to members leaving for various reasons. The following were then elected to office. Mrs. Robinson, president. Vice president, Ruth Heppel; Secretary, Evelyn Thigpen Bryden; Treasurer, Evelyn Mayers.

Charles St. John entered the University of Louisville Medical School, Bartholomew Clemente and William Davis entered Ohio State Medical School.

May fifth, Mr. Robert Bryden spoke on the relation of fishes and swimming mammals to the aircraft industry. Dr. Walter C. Kraatz gave a brief report of the zoological papers presented at the meeting of the Ohio Academy of Sciences held April 30-May 1 at Columbus, Ohio.

Miss Ruth Heppel received her master's degree last June.

An informal meeting closed the school year. It was held at the home of Dr. Kaatz, our advisor. At this meeting the following were initiated: George Duffey, Martha Klein, and Martha Til-

ock Van Bolt, Glenn Black, William Blank, Victor Nelson, and Mary Buckmaster were pledged.

EVELYN THIGPEN BRYDEN,
Secretary.

Nu

—Washington and Jefferson

The annual banquet and initiation were held November 11th at the George Washington Hotel. Dr. McKinsty, a local physician and head of the local sanatorium was the speaker. Six new members were initiated. Dr. McKinsty spoke on "Medicine and Pre-Medical Training".

Sigma

—University of Florida

Despite the trying times Sigma Chapter has to face to follow a regular schedule of activities and to increase its membership, a special effort is made this year to keep the chapter an active one of the Phi Sigma Society. Two meetings have been held. The opening one October 4th was devoted entirely to the general planning of the program for the year and nomination of the different committees. The meeting of November 1st dealt mostly with the election of possible new members. This was followed by an informal talk on "Problems in Public Health in Occupied France". A brief social gathering followed both meetings.

The officers of the chapter are: President, Mrs. Olive L. Goin; Vice-President, Mr. Erdman West; Treasurer, Miss Lillian E. Arnold; Secretary, Mrs. Yvonne T. Brannon.

YVONNE T. BRANNON
Secretary

Phi

—University of New Hampshire

The officers of Phi Chapter of Phi Sigma for the school year 1943-44 are as follows: Mr. Raymond W. Barratt, President; Miss Elizabeth Murphy,

Vice-President; Miss F. Eaton, Treasurer; Miss Helen Rzeznikiewicz, Secretary; and Mrs. Raymond W. Barrat, Corres. Secretary.

The summer activities consisted of two meetings. One was a biological field trip with three professors leading it, Prof. C. F. Jackson covered animal life, Prof. C. L. Stevens covered trees, and Dr. Albion Hodgdon covered plants and fungi. The second meeting was an illustrated lecture of the University of New Hampshire Forestry Summer Camp at Passaconaway, New Hampshire.

The fall season started with seven student members and twenty faculty staff members. After our initiation, we now have twenty students and another faculty member.

Many of the members are temporarily members of the U. S. Coast Guard Reserve. Their duty is to give one night a week (12 hours) to active coast guard work. This usually consists of patrol work.

Four of the members of Phi Chapter have been lost in this war. Raymond S. Wood '39 was killed early in 1943. Evert H. Smith '42 was killed in action. Lt. Jack W. Kirk '41 received the Silver Star for gallantry in action, then later was killed. He received the Purple Heart posthumously. He is survived by a wife and daughter. Lt. (j.g.) B. Bronstein '36 was lost when the U. S. destroyer, Jacob James, was sunk off Cape May, New Jersey. He was a graduate of Tufts Medical School. Recently a new destroyer was named for him.

Phi Chapter is inviting the Pre-Medical students of the Army Specialized Training Program on campus to our open house meeting. Phi Sigma members of this group are also invited to regular meetings. One such member is Pfc. Clifford R. Pollock of Upsilon Chapter, of Miami University.

The Biological Institute of the University is bringing to completion a Biological Survey of the Great Bay of New Hampshire. This is a three-year project with the work almost completely done by Phi Sigma members.

Dr. A. R. Hodgdon is doing research work on "*Lilium superbum* and other isolated plants in Southern New Hampshire", and on "*Mikania scandens* in

Southern New Hampshire". The papers will be forthcoming soon. These brief articles discuss the occurrence of the species listed in New Hampshire and adjoining states. They represent considerable extension of range in each case.

Some other research problems being conducted by graduate student members of Phi Sigma consist of the following: "Sodium tetrphosphate—a possible phosphate salt for use in the study of mineral nutrition in plants" by Fern Drumbheller. "Copepods in Great Bay" by Elizabeth Murphy. And Histogenesis of the reproductive organs of the clam, *Mya arenaria L*" by Elizabeth Garman.

HELEN RUGGLES BARRATT
Corres. Secretary.

Chi

—Montana State College

Although war has hit the Chi Chapter we have managed to keep active. We are now trying to pledge those who are eligible so that we can keep up the standards of our organization.

Dr. W. E. Booth, an active faculty member has been called to the service. Dr. D. L. Pletsch left for the service last spring and is now a Lt. in the Medical Corps. Dr. R. W. Riatt left us rather unexpectedly this fall when he accepted a position at the University of Hawaii.

The officers for the year are Marion Border, President; Rhoda Anne Hoverson, Vice-President; Lois Noble, Secretary; and Margaret Hollenback, Treasurer.

Miss Noble was injured this fall so this report was sent in by

YOKICHI ITOH

Alpha Alpha

—University of Southern California

The August newsletters were sent out to the soldiers. (They were unusually interesting-Ed.) The August 15th meeting was held in the Fern Dell of Griffith Park in Los Angeles. Dr. Thomas Clements of the Department of Geology spoke on "The Role of Geology in Plant and Animal Speciation." September 10th we were very

fortunate to have Dr. John A. Comstock, Director of Science of the Los Angeles Museum of History, Science and Art, who spoke on "Camouflage in Nature." In October Mrs. Mary V. Hood took us on a "Kodachrome Visit to Sequoia National Park."

A special half hour program has been inaugurated to precede our regular meetings. Book reviews, research reports, and reports of scientific meetings have proved very profitable and have had a favorable reception.

Mr. Theodore Payne of the Payne Native Plant Nursery spoke to us in November on "Preserving the Wild Flowers and the Native Landscapes of California." Mr. Payne has done an outstanding service in the conservation of native plants in this area by fostering the use of these plants for landscaping.

The members of our chapter are very busy collecting material for our newsletters to our boys in the service. We have established a system of telephone reporting to cover the members in the metropolitan area. Our Service Chairman cooperates closely with our Special Foundations Officer to keep the University Service Roll up to date.

FRANCES L. CRAMER,
Secretary.

Alpha Kappa

—Hunter College

Seminars have been conducted throughout the year, and papers have been presented that were of vital interest to us. Gertrude Gallant presented the first paper on "Early Traces of Human Vitamin B Deficiency." Sylvia Charlow who is working for Burroughs Wellcome, discussed "Rat Assays for Vitamin B." A paper on "Biotin" was given by Helen Sternberg. Edith Spitzer revealed some very interesting information concerning "Parasitology." Marjorie Berman summarized her work with Dr. Beach in the Department of Experimental Biology at the American Museum of Natural History in a paper on "Nervous System Studies on the Frog."

The initiation dinner was held at the Hotel Barbizon on June Twenty-first. The following fourteen new members

were initiated — June Berg, Grace Clarke, Eileen Feldbaum, Marion Goldberg, Elaine Hammer, Helen Kameros, Hilda Ludwig, Ruth Markowitz, Esther Meyer, Sylvia Preston, Bertha Ruze, Beatrice Scott, Elsie Sklar, Vera Oneskevich. Dr. Albert Gordon of New York University talked on "The Effects of High Altitude on the Physiological Mechanism." He revealed some interesting and vital information on the changes in the Endocrines under the influences of low pressure as shown by studies at his University. The award of the Phi Sigma medal to Beatrice Scott was announced at the dinner.

SHIRLEY R. DUSHKIND,
President.

Alpha Lambda

—University of Utah

Our chapter decided to select only such activities as would constantly place the name of Phi Sigma Society before the campus and general public. Dr. L. P. Gebhardt, bacteriologist of the University's School of Medicine addressed us at the November meeting on "Experimental Virus Studies." His lecture was illustrated and gave us some of the methods used and problems involved in the current poliomyelitis epidemic in the state of Utah.

Assisted by a Faculty Committee appointed by Dr. R. V. Chamberlin, head of the Biology Department we are preparing for an "Open House" to be held about December 17th. Displays and charts will be set up in various rooms and "tours" conducted by members of the chapter as leaders will explain the exhibits. Dr. Walter P. Cottam, the chapter's faculty sponsor, will give an illustrated talk as the climax of the event.

The Phi Sigma News Bulletin is now in its second volume. It is our most important project for the duration.

The coat-of-arms of the Society now has a place of honor in a glass front cabinet near the main entrance of the Biology Building. A small card explaining the purpose of Phi Sigma, is also in the case. The placing of the coat-of-arms in this conspicuous spot has created much interest among students coming to classes in the Biology Building. We are confident of future

benefits from this medium of placing the organization before the campus.

Christmas cards to members of the armed services are two photographs; one of the faculty of the department and the second of the present members of the chapter. All were autographed and personal messages added. These pictures were made a possibility through the time and effort of the sponsor, Dr. Cottam.

DOROTHEA UPP MULAİK.
Secretary.

Alpha Omicron

—Marquette University

Since Marquette adopted the tri-semester school year our Society has been able to include more out door activities during our year's program.

This summer we visited the Conservatory and learned much about plant propagation. A trip to the Zoo was also a part of our summer program.

RUTH E. GASS.
Corres. Secretary.



Book Reviews

LABORATORY EXPLORATIONS IN GENERAL ZOOLOGY by KARL A. STILES and BERT H. BAILEY. *Macmillan, New York.* 1943.

The foreword is excellent. It gives teachers a reason for presenting the material. It helps the student to analyze and know why the study is made. Why we suspend judgment, are critically minded and use scientific methods in personal problem-solving. What the laboratory procedure is. Each exercise has concise directions and contains some very excellent drawings as examples, which are to be filled in and labeled. There are questions and problems for the study of each phylum presented. Demonstrations are suggested for the teacher to help make the student see important structures. The statement "How do we inherit gives problems, explains the collecting of data, organization of data and conclusions drawn from same. It also helps with Library research and the writing of a scientific report. In my opinion an excellent set of Laboratory directions.

INTRODUCTORY ANIMAL HUSBANDRY by ARTHUR L. ANDERSON. *Macmillan Company, New York.* 1943. Price \$4.00.

A practical text for college students and for courses in vocational agriculture. Different types of livestock such as cattle, dairy and dual-purpose cattle, swine, sheep, horses and mules are discussed from the standpoint of types, grading, pedigree, production, feeding, market values, and general uses of each. References and illustrations are adequate and the text covers the fundamental problems and contains many interesting facts of great interest to others as well as students of animal husbandry.

PRACTICAL EMULSIONS by H. BENNETT. *Chemical Publishing Company, Brooklyn, New York.* Price \$5.00.

A very complete collection of information on emulsions which can be used by the practical worker. Here can be found information which will help in understanding the technique and formulation necessary to produce a good emulsion. The formulations have been tested and are presented in such a manner that workers can find information on agents, types of emulsions, and foams, methods, dispersing agents, etc. Examples used are such that people in many fields can find material to help their work. There is a long list of emulsions and formulas. An excellent book for practical workers and students of Biochemistry.

ANATOMY AND PHYSIOLOGY by JESSE FEIRING WILLIAMS. W. B. Saunders Company, Phila. Pa. 1943. Price \$2.75.

A revised edition which is quite an improvement in the method of presenting factual information. Systems have been unified so the student will get a clear conception of the usefulness of structure and functions of organs and systems of man. The first chapter contains some clear cut diagrams and pictures which gave a concise explanation of the development of a cell through its various stages into a complete human organism. The discussion of the complete organism leads to human anatomy which has the physiological facts woven in to the study of systems. The organism as a whole is studied from the outer surface and followed by the regular presentation of skeleton, muscles, nervous system, etc. The book should be of great help to the student because a plan of study is

given at the end of each chapter followed by a practical exercise and questions. This feature should recommend the book highly as the majority of students do not know how to study.

DISEASES OF THE SMALL DOMESTIC ANIMALS by OSCAR VICTOR BRUMLEY, D. V. M. *Lee & Febiger, Phila., Pa. Price \$5.00. Sept. 1943.*

The layman as well as veterinarians and research workers should welcome the fourth edition of this book. The presentation of every disease of the

dog, cat, and rabbit as well as other small animals is given with the latest scientific developments on each. The diseases of the respiratory system, circulatory system, digestive tract, reproductive organs, metabolism, organs of locomotion, urinary system, nervous system, skin, ear, and eye are described with causes, symptoms and treatments. The material contents are easy to read and give the proper procedure in simple and concise statements. The illustrations are a welcome addition and help to give clear cut ideas of the facts concerned. A book to be recommended to all persons interested in small domestic animals.



SUBSCRIPTION BLANK

Detach this page, fill out blank spaces, include check or money order and mail to Mr. Stewart.

Date

To Mr. E. H. STEWART,
Treasurer of Phi Sigma,
Mesa, Colorado.

Dear Mr. Stewart:

I am enclosing \$..... for my subscription to THE
BIOLOGIST in the class checked on the schedule below:

1 Year: \$ 1.00.....

3 Years: \$ 2.50.....

5 Years: \$ 4.00.....

10 Years: \$ 7.50.....

25 Years: \$15.00.....

Life Sub: \$25.00.....

Name

Address

.....

Within Reach of Your Chapter Finances

INITIATION INSIGNIA

Does your Chapter carry out the Ritual of Initiation properly? In other words, has your Chapter the model Phi Sigma Key and the large Phi Sigma Coat of Arms required by the Ritual? They are both in easy reach of every Chapter's finances.

The Model Key, furnished in two colored gold, costs only \$1.75.

The Coat of Arms, hand-colored on 12x16 heavy paper, only \$1.25.

Address all orders, and make all checks payable to the Secretary, Dr. A. I. Ortenburger, Department of Zoology, University of Oklahoma, Norman, Oklahoma.

PHI SIGMA JEWELRY

Membership keys may be obtained from the National Treasurer through Chapter Treasurers, or directly. In the latter case give your name, Chapter and year of initiation, *plainly*.

REVISED PRICES OF KEYS

Standard Size (official) 10K gold

Swivel ring top	\$5.50
Stationary ring top	5.00
Swivel ring top; mounted as pin; safety clasp	6.75
Stationary ring top; mounted as pin; safety clasp	6.25

Small Size 10K gold

Swivel ring top	5.00
Stationary ring top	4.50
Stationary ring top; mounted as pin; safety clasp	5.50
Green gold keys, additional	2.00
White gold keys, additional	5.00

To the foregoing prices 10% must be added to cover Federal defense tax.

Address correspondence to:

MR. ERWINE HALL STEWART,
Treasurer of Phi Sigma,
Mesa, Colorado

The Duties Of The Chapter Secretary

To the National Secretary:

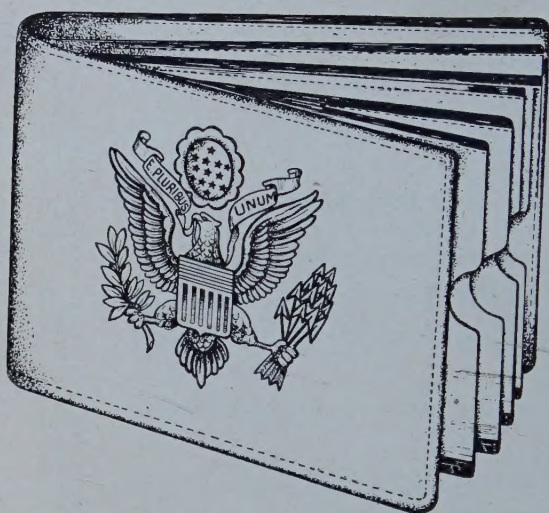
1. At the beginning of each school year furnish the names *and* addresses of chapter officers.
2. Order all chapter supplies well in advance of time needed.
3. Order certificates at least two weeks before initiation date.
4. Send initiation fees and membership record blanks at time certificates are ordered.
5. Be sure that copies of THE BIOLOGIST are received by *all* members including faculty and honorary members.

To the National Treasurer:

1. Furnish correct list of chapter officers and addresses.
2. Inform the national treasurer at least a month in advance of the correct number of BIOLOGISTS needed for all your members.
3. Report name, serial number and date of initiation of each initiate at time certificates are ordered.

To the Editor:

1. Furnish a correct list of chapter officers and addresses.
2. Send chapter news letters for BIOLOGIST at least four weeks in advance of publication.
3. Send in copies of outstanding biological lectures or addresses (not however research reports) delivered at your institution.
4. Send in helpful suggestions or constructive criticisms concerning THE BIOLOGIST.



SERVICE INSIGNIA AVAILABLE

ARMY SEAL

ARMY WINGS

MARINE CORPS

WING AND PROPELLER

NAVY SEAL

NAVY WINGS

NAVY ANCHOR

Specify insignia desired when ordering.

*One Gift He
Will Welcome*

MILITARY BILLFOLD

Branch of service insignia is deeply blind embossed on cover. Bill compartment, two card pockets and four transparent wings for passes.

580-44 Saddle Sheepskin Leather.

Blind embossed service insignia . . \$3.50 (no tax)

Name gold stamped inside billfold at 25c per line additional.

1944 BALFOUR BLUE BOOK

Features the Victory ring for men and also the new miniature sweetheart ring—both available with branch of service insignia. Many rings, lockets, compacts, identification bracelets, and fine leather billfolds and photo frames.

Mail post card for your FREE COPY.

Official Jeweler to Phi Sigma Society

L. G. BALFOUR COMPANY

ATTLEBORO . . . MASSACHUSETTS